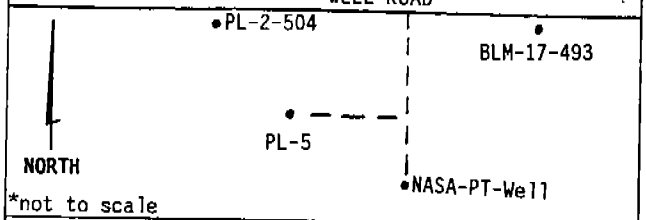
LITHOLOGIC LOG

LOCATION MAP:



*not to scale

NW 1/4 SE 1/4 NW 1/4 NE 1/4 S5 T21S R3E

SITE ID: NASA-WSTF LOCATION ID: PL-5 (Westbay Well)

SITE COORDINATES (ft.):

N 226966.72 E 401507.49

GROUND ELEVATION (ft. MSL): 4512.60 (BC)

STATE: NEW MEXICO COUNTY: DOÑA ANA

DRILLING METHOD: Mud Rotary

DRILLING CONTR.: Beylik Drilling, Inc.

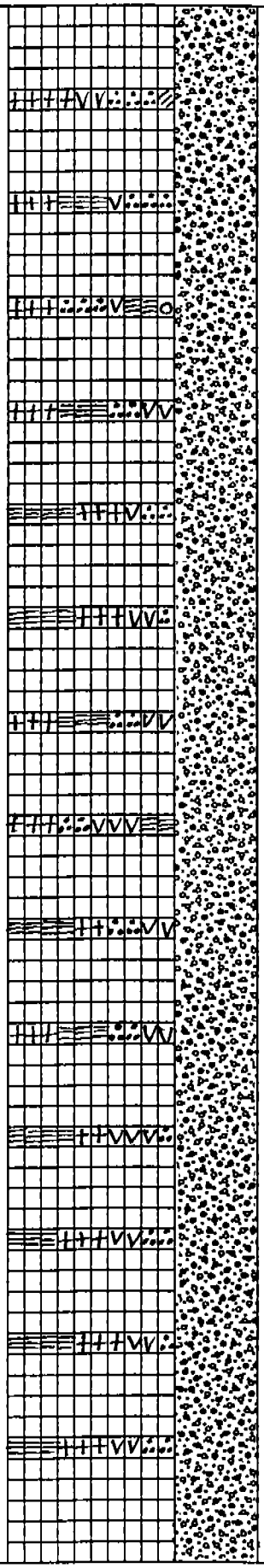
DATE STARTED: 10/02/90 DATE COMPLETED: 11/10/90

FIELD REP.: J. Rogers, C. Werden, S. Dubyk

COMMENTS: 20" tricone bit to 24.2'; 14" surface casing set to 24', 12¼" tricone bit to 1023'. Andesite-rich alluvium at 580', bedrock (andesite) encountered at 1007'. TD = 1023'

Depth	Visual %	Lith	Drilling Time Scale: min	Sample Type and Interval	Lithologic Description
5			0'-185' not timed	Cuttings 0'-1023	0-1007' Alluvium (Santa Fe Group): Multicolored due to the many different lithologic constituents; cuttings range in size from <.1 to 1 inch and are angular to subrounded. Natural grains include clay, silt and fine to coarse, angular to rounded sand. Sorting is poor to medium. The formation is an unconsolidated to consolidated polygenetic cobble to boulder conglomerate. Lithologies comprising this conglomerate are limestone, caliche, rhyolite, andesite, quartz, sandstone, and siltstone. Comments: This section contains clay, gravelly-clay and sandy clay lenses from 0'-360', 545'-690', and 785'-885'. The andesite becomes the greatest volcanic fraction by 490' and the alluvium is considered andesite-rich by 580'.
10					
15					
20					
25					
30					30' Sand and gravel with much less clay. .1" - .3" angular fragments comprise 30% and rounded grains comprise 70% of sample.
35					
40					
45					45' Grain size increases and more natural grains are present. Subangular clasts are .1" - .4".
50					

Depth	Visual %	Lith	Drilling Time Scale: min	Sample Type and Interval	Lithologic Description
			0-185' not timed	Cuttings (cont'd)	
50			-		
55			-		55' Decrease in grain size. 60% of sample is predominantly rounded to subrounded (.1" - .2" diameter). 10% of the angular chips are limestone and rhyolite. Increase in caliche.
60			-		60' Increase in grain size. Subangular to angular limestone and rhyolite (.1" - .3" diameter).
65			-		
70			-		70' Increase in grain size, clay lense to 80'.
75			-		
80			-		80' Caliche cement on most larger cuttings. Predominately subangular to subrounded grains.
85			-		85' ~10% of sample is carbonate cement that can also be seen on cuttings. Decrease in grain size. 70% of sample predominantly subrounded (<.2" diameter).
90			-		
95			-		95'-100' Clay layer, sample consists of 80% coarse sand, 20% gravel, and minor caliche.
100			-		100'-105' Increase in grain size to gravels: 15% are .75" - 1.00", 20% are .25"-.75" and 65% are <.25 in diameter.
105			-		105'-110' Decrease in grain size. 95% of sample is ≤ 0.1", while 5% is .1-.5" in diameter. Coarse sand with no caliche.
110			-		110'-115' Increase in grain size. Sample consists of 70% gravel, 30% coarse sand, and minor clay.
115			-		

Depth	Visual %	Lith	Drilling Time Scale: min	Sample Type and Interval	Lithologic Description
			0'-185' not timed	Cuttings (cont'd)	
115			-		115'-120' Minor decrease in grain size, increase in clay: Gravelly sand (60% gravel, 40% coarse sand).
120			-		120'-125' Increase in clay content, sample is gravelly sand as above.
125			-		125'-130' Gravelly sand, clay, no caliche.
130			-		130'-135' Increase in clay, gravelly clay sand. Gravel up to .5" diameter.
135			-		135'-140' Gravelly sand, gravel is angular to subrounded, coarse sand. Clay-rich, trace of caliche.
140			-		140'-145' Medium to coarse sand, 10% gravel to .3".
145			-		145'-150' Gravelly sand: gravel 10-15%, coarse sand. Gravel and sand angular to rounded.
150			-		150'-155' Sandy gravel: gravel to ~.5", rounded to angular. Coarse sand, rounded to subangular.
155			-		155'-160' Gravelly sand: gravels up to 10%, rounded to angular. Less clay, medium to coarse sand, rounded to subrounded.
160			-		160'-165' Sandy gravel: 65% gravel, 35% sand, gravel to .5", angular to subrounded, medium to coarse sand, rounded to angular.
165			-		
170			-		170'-175' Gravelly clayish sand. Gravel to .5". Medium to coarse sand.
					170'-175' Gravelly clayish sand. Gravel to .5". Medium to coarse sand.
175			-		175'-180' Gravelly clayish sand. Large chips from volcanic boulders. Gravel 5%. Coarse to medium sand both angular to subrounded.
180			-		

LOCATION ID: PL-5

Depth	Visual %	Lith	Drilling Time Scale: min	Sample Type and Interval	Lithologic Description
			(24 hour time)	Cuttings (cont'd)	
180			-		180'-185' Gravel/sand: predominantly paleozoic limestone, silicious shales, minor volcanics; same lithology in sand, medium to coarse grained, no clay.
185			185'-1020' drillograph		185'-190' Gravel/sand. Same as above, some effervescent clay.
190			53		190'-195' Clay, pale yellowish brown, cohesive, with gravel and sand, limestone, volcanics and sandstone.
195			29		195'-200' Gravel/sand; coarse sand to fine gravel, limestone, silicified shale, volcanics.
200			38		200'-205' Clayey gravel/sand; coarse sand and gravel, predominantly limestone and volcanics, with clay.
205			33		205'-210' Clayey gravel/sand. As above.
210			35		210'-215' Clayey gravel/sand, coarse sand to fine gravel, slight decrease in clay.
215			31		215'-220' Clayey gravel/sand, as above, slight decrease in clay, increased volcanics.
220			29		
225			24		
230			18		
235			16		
240			17		
245			77		

Depth	Visual %	Lith	Drilling Time Scale: min	Sample Type and Interval	Lithologic Description
				Cuttings (cont'd)	
245			77		245'-255' Clayey gravel/sand. Medium sand to fine gravel.
250			18		
255			17		255'-260' Limestone gravel, some clay, some quartzite. Boulder at 262'.
260			13		260'-270' Gravel/sand. Medium gravel, poorly sorted, angular to subrounded, limestone, quartzite. Some clay.
265			50		
270			25		270'-275' Clayey gravel; fine to coarse sand, fine to medium gravel. Predominately limestone, some quartzite.
275			10		275'-285' Gravel/sand some clay, coarse to fine sand. Gravel, poorly sorted. Predominately limestone and quartzite.
280			28		
285			12		285'-290' Slightly more clay.
290			24		290'-300' Gravel; sandy ranging from coarse sand to medium gravel. Predominately iron gravel. Moderately sorted, predominantly limestone.
295			19		
300			17		300'-305' Gravel; clayey, sandy ranging from fine sand to coarse gravel, predominantly fine gravel, poorly sorted. Increase in clay content.
305			37		305'-310' Gravel; clayey, sandy, same as above.
310			28		

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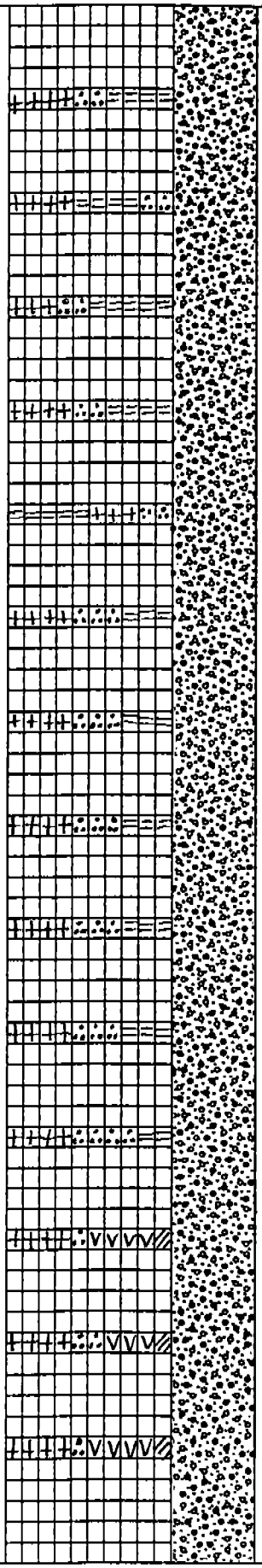
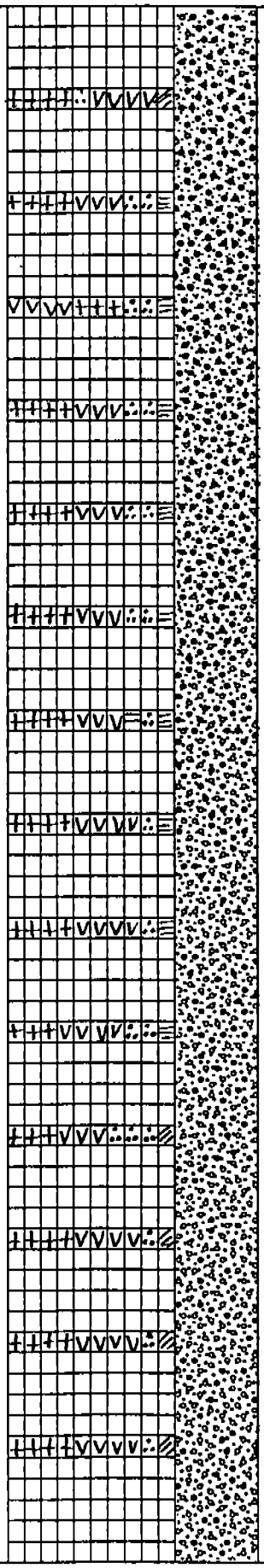
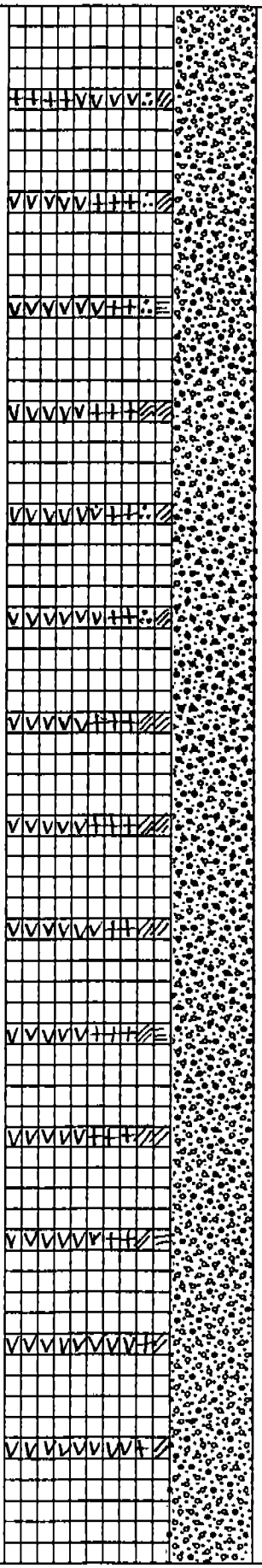
				Cuttings (cont'd)	
310			28		310'-315' Gravel; clayey. Sandy ranging from fine sand to medium gravel. Predominately fine gravel, poorly sorted subangular. Predominately limestone.
315			20		310'-315' Same as above, slightly more clay.
					315'-320' Gravel; clayey, sandy, ranging from fine sand to medium gravel. Predominantly fine gravel, poorly sorted. Predominantly limestone, some quartzite.
320			15		
					320'-325' Clay; sandy, few pebbles. Smooth yellowish brown.
325			20		
					325'-330' Sand; clayey, gravelly, ranging from fine sand to medium gravel. Predominantly coarse sand. Predominantly limestone and quartzite, poor to moderately sorted.
330			11		
					330'-335' Gravel; sandy, clayey ranging from fine sand to medium gravel. Predominantly fine gravel. Poorly sorted. Predominantly limestone.
335			15		
340			10		
345			81		345'-350' Gravel; sandy, clayey ranging from fine sand to medium gravel. Predominately fine gravel, poorly sorted.
350			14		350'-355' Predominately limestone. Some quartzite.
355			21		355'-360' Gravel; sandy, some clay ranges from fine sand to medium gravel, predominately fine gravel, moderately sorted.
360			23		360'-370' Limestone/volcanic gravel with little to no clay. Volcanics include mostly rhyolite.
365			60		
370			10		370'-375' Limestone/volcanic gravel, coarse sand, volcanics mostly rhyolite. Sandstone and siltstone.
375			10		

Depth	Visual %	Lith	Drilling Time Scale: min	Sample Type and Interval	Lithologic Description
				Cuttings (cont'd)	
375					375'-380' Limestones/volcanic, gravelly sand. Volcanic mostly rhyolite, trace of andesite.
380			10		380'-385' Sand, coarse to medium. Gravels up to .25". Volcanic/limestone gravel. Rhyolite and minor andesite.
385					385'-390' Limestone/volcanic gravel. Predominant rhyolite as above. gravel < .2", angular, coarse sand.
390			32		390'-405' Limestone/volcanic gravel, coarse sand.
395			17		
400			15		
405			31		405'-410' Volcanic (rhyolite > andesite)/limestone sandy gravel. Gravels ≤ .25". Angular to subrounded. Sand coarse, angular to subrounded.
410			12		410'-415' Volcanic/limestone sandy gravel as above.
415			14		415'-420' Volcanic/limestone sandy gravel.
420			18		420'-425' Coarse gravel/sand, angular to subangular, gravel to .3".
425			53		425'-440' Limestone/volcanic arenite, coarse sand.
430			18		
435					
440			40		

LOCATION ID: PL-5

Depth	Visual %	Lith	Drilling Time Scale: min	Sample Type and Interval	Lithologic Description
				Cuttings (cont'd)	
440					440'-445' Volcanic/carbonate gravel, coarse sand slight increase in average grain size, gravels ≤ .3". Calcium carbonate cement on grains.
445			31		445'450' Increase in volcanic fragments, same as above.
450			23		450'-455' Volcanic-rich gravel of coarse sand. Rhyolite > andesite.
455					
460			19		460'-465' Clays blue-grey (below water table?)
465			48		465'-475' Volcanic (buff rhyolite), light to dark grey limestone, buff siltstone chips' ≤ .3"
470			21		
475			23		475'-480' Slight increase in volcanics, rhyolite > andesite, chips ≤ 0.4".
480			29		480'-485' Same as above, ≤ 5% clay balls.
485			23		485'-490' Same as above, no clay.
490			22		490'-495' Volcanics - andesite > rhyolite, light to medium grey limestone, medium grey siltstone, a few clay balls ≤ 0.4" in sample.
495			25		495'-500' Increase in percent volcanics (andesite > rhyolite), no clay.
500			25		500'-505' Same as above; ≤ 0.5" angular to subrounded cuttings.
505			46		

LOCATION ID: PL-5

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	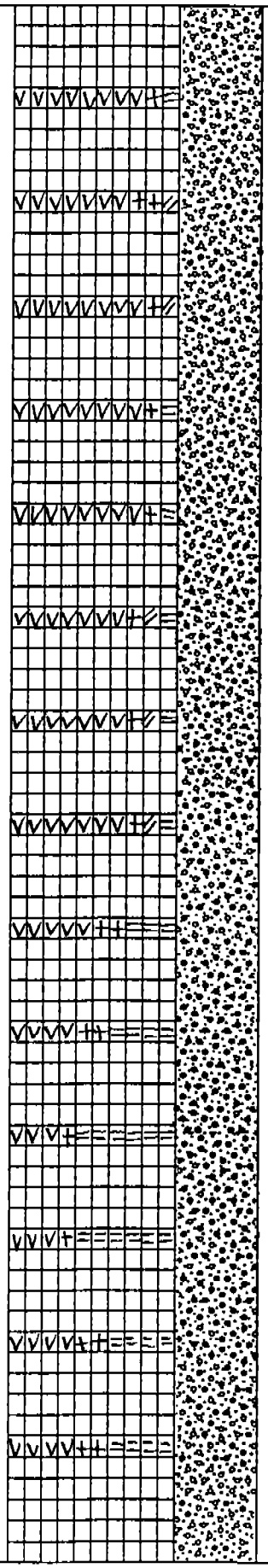			Cuttings (cont'd)	
505			-		505'-510' Volcanics, 75%, and 25% rhyolite, medium to dark grey limestone and siltstone. Cuttings are angular to rounded, < .06" in size.
510			39		510'-515' Same as above, slight increase in volcanic percent.
515			26		515'-525' Predominantly dark red, medium to dark grey and lesser tan-brown rhyolite, sparse limestone, few clay balls in sample.
520			22		525'-535' Same as above except slight increase in percent of limestone and siltstone fragments. Angular to subrounded, a few clay balls in sample. Slight decrease in particle size.
525			31		
530			43		
535			22		535'-540' Same as 525'-535'. Particle size ≤ 0.4". Gravels; sandy, clayey, ranging from fine sand to medium gravel. Predominately fine gravel, poorly sorted. Predominately igneous.
540			37		540'-545' Sands, gravels, very clayey. Predominately volcanics and limestone, angular, some siltstone chips.
545			77		545'-550' Same as above. Slightly more clayey. Purple cuttings, increase in andesite.
550			12		
555			22		555'-560' Same as above, slightly less clay content. Drilling indicates more cobbles and boulders.
560			12		560'-565' Sandy, very clayey, gravely. Predominately igneous, some quartzite, some carbonates, angular, poorly sorted. Drilling in this interval smooth.
565			19		
570			13		

LOCATION ID: PL-5

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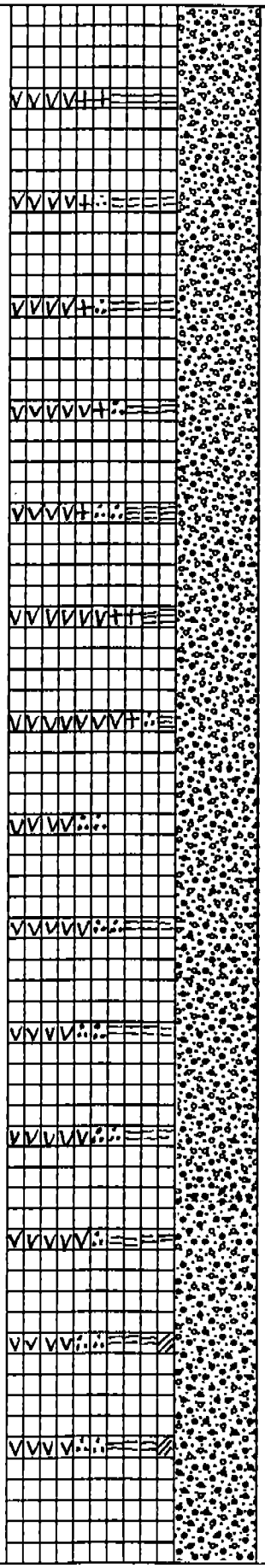
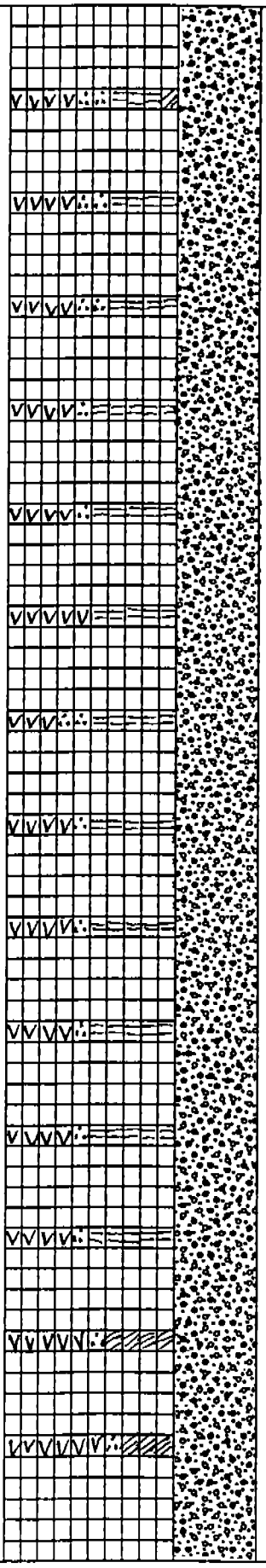
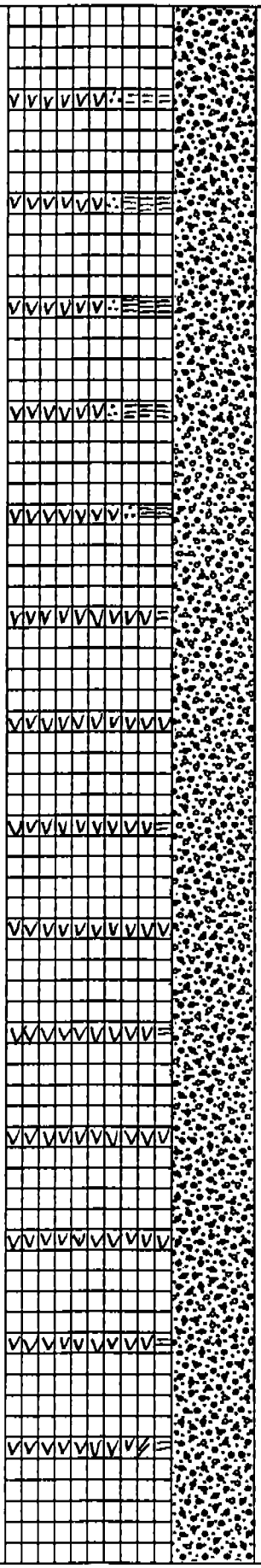
				Cuttings (cont'd)	
570			13		570'-575' Sands; very clayey, gravely, predominately igneous, some siltstone, quartzite and occasional limestone. Poorly sorted, subangular, occasional cobble.
575			17		575'-580' Same as above, slightly less clay - more sand.
580			10		580'-585' Andesite percentage is much greater than rhyolite, siltstone, limestone. Probable contact with andesite-rich alluvium.
585			18		585'-590' Increase in sedimentary cuttings, possibly from up-hole, lodged loose while tripping pipe.
590			-		590'-600' Andesite gravel, coarse sand, alluvium.
595			22		
600			16		600'-605' Sands; very clayey, gravely ranging from fine sand to medium gravel. Predominately coarse sand, moderately sorted. Predominately andesite, some rhyolite, predominately angular, gray and black.
605			-		605'-620' Same as above, slightly coarser material. Predominately fine gravel.
610			15		
615			17		
620			25		620'-625' Boulders at 627'.
625			24		625'-635' Same as above, increasing siltstone fragments.
630			16		
635			10		

Depth	Visual %	Lith	Drilling Time Scale: min	Sample Type and Interval	Lithologic Description
635			10	Cuttings (cont'd)	
640			10		638' Boulders @ 638 ft.
645			25		
650			5		
655			10		
660			20		
665			13		
670			5		
675			36		
680			28		
685			29		
690			17		690'-700' Sand and gravel conglomerate. Drilling hard, ranging from fine sand to cobbles. Predominately very coarse sand, angular. Predominately andesite, some clay decreasing with depth, poorly sorted, gray to black.
695			32		
700			43		

Depth	Visual %	Lith	Drilling Time Scale: min	Sample Type and Interval	Lithologic Description
				Cuttings (cont'd)	
700			43		700'-715' Andesite-rich alluvium, welded tuff.
705			-		
710			99		
715			46		715'-720' Calcite crystals and veinlets on volcanics.
720			41		720'-725' 95%+ volcanics; andesite, brick red, maroon, or grey. Occasional fragments of rhyolite, limestone, calcite, a few clay balls in sample. Angular to subrounded.
725			-		725'-730' Andesite, same colors as 720'-725', occasional calcite fragments. Angular to subrounded particles.
730			22		730'-735' Same as 720'-725'. Largest fragment 0.4".
735			23		735'-740' Same as 720'-725' except no clay in sample. Angular to subrounded particles.
740			19		740'-745' Same as 720'-725'.
745			44		745'-750' Andesite; brick red, maroon, medium brown, medium dark gray, occasional rhyolite fragment. < 1% clay, angular to subrounded.
750			22		
755			16		755'-760' Same as 745'-750' except clay 5-7%.
760			17		760'-765' Andesite; same as 745'-750', buff calcareous siltstone fragments ≤ 0.7", a few clay balls in sample.
765			54		

LOCATION ID: PL-5

Depth	Visual %	Lith	Drilling Time Scale: min	Sample Type and Interval	Lithologic Description
				Cuttings (cont'd)	
765			18		
770			16		770'-775' Andesite; brick red, maroon, medium to dark grey. Occasional light tan rhyolite fragments, a few clay balls. Angular to subrounded particles ≤0.3".
775			17		775'-780' Andesite; same as 770'-775'. Very sparse limestone and calcite fragments, and clay.
780			38		780'-785' Andesite; same as 770'-775'. Medium brown clay with abundant imbedded rock fragments <5%. Tan light brown calcareous siltstone < 0.5"
785			14		785'-790' Same as 780'-785' except no siltstone.
790			19		790'-795' Same as 785'-790', silt. Decrease in clay percent.
795			19		795'-800' Same as 785'-790', except increase in clay percent.
800			54		800'-805' Same as 795'-800'.
805			14		805'-835' Andesite; brick red, maroon, medium dark grey particles ≤ 0.1". Angular to subrounded.
810			21		
815			20		
820			23		
825			18		
830			19		

LOCATION ID: PL-5

Depth	Visual %	Lith	Drilling Time Scale: min	Sample Type and Interval	Lithologic Description
830			18	Cuttings (cont'd)	
835			19		
840			9		
					843' Drilling hard, possibly bedrock contact.
845			20		
850			17		
855			35		
860			24		859' Believed to have encountered bedrock. Drilling chips typical of andesite bedrock. Will drill another 10'.
865			29		
870			25		869' Does not appear to be andesite bedrock.
875			65		
880			15		
885			16		885'-920' Slightly less clay content.
890			29		
895			55		

LOCATION ID: PL-5

Depth	Visual %	Lith	Drilling Time Scale: min	Sample Type and Interval	Lithologic Description
				Cuttings (cont'd)	
895			-		
900			-		
905			-		
910			-		
915			80		
920			10		920'-950' Same as above, increase in rhyolite.
925			16		
930			10		930'-955' Increase in clay content.
935			8		
940			2		
945			34		
950			-		
955			-		955'-970' Same as above, less clay.
960			-		

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	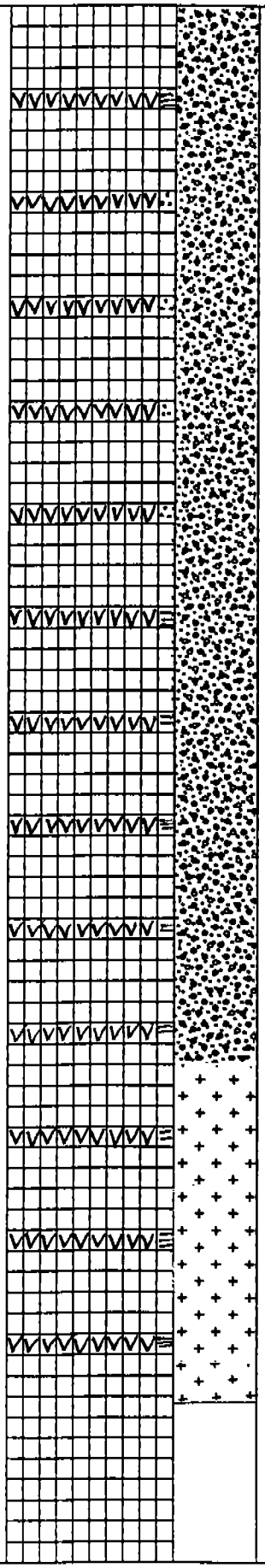			Cuttings (cont'd)	
960			-		
965			-		
970			-		970'-975' Same as above, more angular.
975			-		
980			206		980'-995' Volcanic gravel/sand.
985			-		
990			13		
995			5		
1000			-		1000' -1005' Same as above and blue-grey clay.
1005			-		
1010			-		1007' -1020' Andesite (Orejon): Dark bluish-black aphanitic andesite. Cuttings are angular and uniform.
1015			-		
1020			-		1023' Total Depth (TD)
1025					